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ABSTRACT

This document is the first step in developing a curriculum program for electronic technicians and mechanics in Oregon; it identifies the skills necessary for employment as identified by industry, but it is not a curriculum guide. A task inventory for specific skills for an electronics technician includes task descriptions for the following duties: adjusting/aligning/calibrating electronic circuitry; designing equipment and circuitry; performing environmental tasks; maintaining electronic devices; replacing components; and administering personnel. Descriptions of duties may include information on the following: tasks, level, performance objectives, tools and equipment, and performance guide. Each skill is ranked as entry level (needed to get the job), retention level (needed to keep the job), or advanced level (needed to advance in the job). Frequency of use for tools/equipment and electronics technical committee membership are listed. (NLA)

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# Report of the Technical Committee for Electronics

September 1986

Oregon Department of Education
700 Pringle Parkway SE
Salem, Oregon 97310-0290

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## Preface

The Carl D. Perkins Vocational Education Act (PL 98-524) requires that each state establish at least two technical committees per year. The purpose of these technical committees is to identify the skills and knowledges required for occupations for which training is provided for in the state.

The technical committees are composed of members from business, industry, professional associations, and labor, as well as persons with special expertise. In addition, there is one ex officio representative from each of the following areas:

- State Advisory Council for Career and Vocational Education
- Secondary vocational programs
- Community college vocational programs
- Teacher education/higher education

The committees identify the skills and knowledges required in the occupation at three levels.

1. Entry -- the skills necessary to obtain the job.

2. Retention -- the skills necessary to retain the job beyond the probationary period.

3. Advanced -- the skills necessary to advance in the occupation; i.e., journeyperson level.

This work will be used to determine the competencies required in each vocational program and to improve the existing curriculum statewide.

This report reflects many hours and a strong commitment to educational excellence on the part of the committee members. The Department appreciates the work of the committee.

The committee used the Electronics Mechanic Catalog of Performance Objectives, published by V-TECS, as its main resource document.

For additional information, contact Ron Jantzi, 378-3594.

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# Electronics

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## How to Use the Report of the Technical Committee

The Technical Committee has identified the skills and knowledges required by employees in a certain occupational area. They have also identified the industry standard (in the performance objective) and the steps that are required to accomplish the task to meet the industry standard (performance guide). Many times there are several ways to competently perform a task; the one given is a suggestion.

The report does not differentiate between skills that can be taught at the secondary or post-secondary level. It is a picture of the occupation and the skills an employee must be able to perform. Thus this document is <u>not</u> a curriculum guide. It is the first step of developing your curriculum or program. Each local advisory committee should review the tasks to determine if they meet local needs. Many times there will be additional tasks that the local committee will identify as being necessary.

Each skill in this report is ranked as being Entry (needed to get the job), retention (needed to keep the job), or advanced (needed to advance in the job or be considered fully responsible in the job.).

Once a local committee has reviewed the tasks and the performance objectives, the teacher needs to identify which of these skills are appropriate for each level of instruction. (The statewide education committee will also be doing this and their recommendations can be used as a guide.)

Once the skills have been identified for which instruction will be provided, resources need to be identified and evaluated. Again the statewide education committee will be doing this and recommending 3-4 excellent resources. The teacher/instructor will need to review the material also to determine if additional skills recommended by their local committee are adequately covered.

<u>Again</u>, this document is <u>not a curriculum</u>; it provides the necessary skills for employment as identified by industry. It also provides performance objectives from which competencies and instructional objectives may be written.

For more information and technical assistance, contact the Department of Education, Division of Vocational Education, 378-3584.

## Electronics Technical Committee Membership

1. Industry

| | |
|---|---|
| Moses Davis<br>Department 115, HF2/20<br>Systems Group<br>Intel Corporation<br>5200 NE Elam-Young Parkway<br>Hillsboro, OR 97123 | Manufacturing |
| Dan Phillips<br>Floating Point Systems<br>3601 SW Murray Boulevard<br>Beaverton, OR 97005 | Manufacturing |
| Dick Hornicak<br>Tektronix<br>PO Box 500<br>Delivery Station 54-077<br>Beaverton, OR 97077 | Manufacturing |
| J.D. Brodbeck<br>Hewlett-Packard<br>1000 NE Circle Boulevard<br>Corvallis, OR 97330 | Manufacturing |

2. Professional Associations

| | |
|---|---|
| Pat McCormick<br>American Electronics Association<br>707 13th Street<br>Salem, OR 97301 | |
| Thomas Lawrence, President<br>Kolortron TV & Electronics, Inc.<br>515 Edgewater NW<br>Salem, OR 97304 | Small Business, International Society of Certified Electronic Technicians |

3. Others With Special Expertise

| | |
|---|---|
| Joe Tejadilla<br>Department 115, HF2/20<br>Systems Group<br>5200 NE Elam-Young Parkway<br>Hillsboro, OR 97123 | Research and Development |
| Larry Mulally<br>Electronics Department<br>Rogue Community College<br>100 Blackford Lane<br>Central Point, OR 97502 | |

4. Ex Officio Members

| | |
|---|---|
| Dennis Piper<br>Umpqua Community College/<br>Roseburg High School<br>2531 Bullock Road<br>Oakland, OR 97462 | Secondary |
| Terry Schultz<br>Mt. Hood Community College<br>21032 NE Interlachen<br>Troutdale, OR 97060 | Community College |
| Sam Stern<br>Oregon State University<br>Snell Hall, Room 301<br>Corvallis, OR 97331 | Higher Education/Teacher Education |
| Jim Sayer<br>Route 1, Box 338<br>Forest Grove, Or 97116 | SACCVE |
| Don Fineran<br>Oregon Department of Education<br>700 Pringle Parkway SE<br>Salem, OR 97310-0290 | General Education |

## Statement of the Technical Committee

It is the opinion of the Electronics Technical Committee that the occupation of electronic technician could be broken into three new categories. These would be titled as follows.

1. Electronic Engineering Technician

2. Electronic Manufacturing Technician

3. Electronic Service Technician

If a thorough task analysis were completed on these new job titles, it would be a more realistic picture of today's electronics industry. A new project on Electronic Service Technician has been started and should be completed by September of 1988.

The electronics technical committee agrees that the electronics industry is changing at a very rapid pace. It is the committee's recommendation that each user of the duty/task list review and update it on an annual basis to maintain a current curriculum.

## Summary of Activities

The Electronics Technical Committee met for the first time on August 12, 1986. The first hour of the meeting was to get acquainted with one another and to introduce the project and the expectations of the committee. It was during this part of the meeting that the major differences of opinion between the industry people and the educators first came out with regard to the entry-level skills of an electronics technician. The V-TECS task list was explained at this time and the process "rules" were defined. The industry representatives were able to validate the task list and add other tasks necessary for their industries.

After the tasks were identified, the performance objectives were either approved or new objectives were written. The rough drafts were then retyped in proper format and mailed back to the committee members for a final review.

It was decided by the committee members that an additional meeting was needed to finalize the recommendations of the committee. At the next meeting, held on September 12, 1986, the committee felt the duties of an electronics technician should be different than those identified by V-TECS. The tasks were said to be correct; however, they would be assigned to the new duties.

At that point, the education committee will take the industry committee documents and write any changes and also identify current equipment used in training to the competencies listed. The education committee will also address applicable employability skills, essential learning skills as determined by the committee.

## Occupational Information

A. Occupational Titles

1. The initial assessment of skills inventory was taken from the following vocational titles:

   - Electronic Technician
   - Electronic Mechanic

2. The committee indicated that in many organizations the job title electronic technician is most common. This is the job title studied.

B. Labor Market Data and Trends

1. Projected employment for 1988 for the electronic technician occupation is 3,761.

2. The current trend in the electronic occupation is an increase in technician and service classifications. An increase in the need for computer program skills will rise in areas dealing with diagnosis and testing of electronic systems.

## Task Inventory for Specific Skills

ELECTRONICS TECHNICIAN

| DUTY NO | TASK NO | TASK DESCRIPTION | LEVEL OF SKILL | CROSS REFERENCE PERFORMANCE OBJ |
|---|---|---|---|---|
| A | | ADJUSTING/ALIGNING/CALIBRATING ELECTRONIC CIRCUITRY | | |
| | 1. | Adjust AC signal source output | E | 1 |
| | 2. | Adjust amplifier gain | E | 2 |
| | 3. | Adjust audio level | E | 3 |
| | 4. | Adjust feedback (AGC) circuit | E | 4 |
| | 5. | Adjust bias network | E | 5 |
| | 6. | Adjust capacitance | E | 6 |
| | 7. | Adjust core of slug turned circuit | E | 7 |
| | 8. | Adjust power supply output | E | 8 |
| | 9. | Adjust focus control | E | 9 |
| | 10. | Adjust linearity (vertical/ horizontal) | E | 10 |
| | 11. | Adjust impedance | E | 11 |
| | 12. | Adjust modulation percentage | E | 12 |
| | 13. | Adjust Oscillator | E | 13 |
| | 14. | Adjust output of high frequency amplifiers | E | 14 |
| | 15. | Adjust test equipment calibrator signal | E | 15 |
| | 16. | Adjust voltage | E | 16 |
| | 17. | Calibrate P-P voltage | E | 17 |
| | 18. | Calibrate timing/clock pulse | E | 18 |
| | 19. | Adjust tape reader | R | 19 |
| | 20. | Adjust resonant frequency | R | 20 |
| | 21 | Adjust armature field voltage | A | 21 |
| B | | DESIGNING EQUIPMENT AND CIRCUITRY | | |
| | 1. | Conduct physical inventory | E | 22 |
| | 2. | Construct external interface adapters | ERA | 23 |
| | 3. | Construct tables displaying electronic data (variables, parameters) | E | 24 |
| | 4. | Design physical support hardware for new electronic equipment | E | 25 |
| | 5. | Draw schematic circuitry | ERA | 26 |
| | 6. | Prepare a parts list for prototype equipment | E | 27 |
| | 7. | Translate graphic information into written specifications | E | 28 |

| DUTY NO | TASK NO | TASK DESCRIPTION | LEVEL OF SKILL | CROSS REFERENCE PERFORMANCE OBJ |
|---|---|---|---|---|
| | 8. | Write operational procedures | E | 29 |
| | 9. | Write summary report of operational tests | ERA | 30 |
| | 10. | Design circuits from engineering specifications | E | 31 |
| | 11. | Plan quality assessment checks (physical/electrical) | R | 32 |
| | 12. | Prepare an estimate of production time | A | 33 |
| | 13. | Draft preliminary specifications for an electronic device | A | 34 |
| | 14. | Design interfaces between sub-assemblies (electrical, mechanical) | A | 35 |
| | 15. | Assist in verification of preliminary designs | E | 36 |
| | 16. | Input engineering documentation | R | 37 |
| | 17. | Write program(s) | A | 38 |
| | 18. | Read and interpret diagrams | E | 39 |
| | 19. | Read and interpret flow charts | E | 40 |
| | 20. | Document daily activities | E | 41 |
| C | | PERFORMING ENVIRONMENTAL TESTS | | |
| | 1. | Perform temperature test | E | 42 |
| | 2. | Perform corrosive test | R | 43 |
| | 3. | Perform maximum power test | R | 44 |
| | 4. | Perform pressure test | R | 45 |
| | 5. | Perform shock (impact) and vibration test | R | 46 |
| D | | MAINTAINING ELECTRONIC DEVICES | | |
| | 1. | Assemble structural members | E | 47 |
| | 2. | Clean air filters | E | 48 |
| | 3. | Clean chassis | E | 49 |
| | 4. | Clean circulation fans (exhaust and intake) | E | 50 |
| | 5. | Clean contact points | E | 51 |
| | 6. | Clean drive mechanism | E | 52 |
| | 7. | Clean reflector mirror and lenses | E | 53 |
| | 8. | Clean head tape | E | 54 |
| | 9. | Clean tape reader | E | 55 |
| | 10. | Clean tuner | E | 56 |
| | 11. | Clean potentiometer (volume control, video, chroma, etc.) | E | 57 |
| | 12. | Locate component malfunctions | E | 58 |

| DUTY NO | TASK NO | TASK DESCRIPTION | LEVEL OF SKILL | CROSS REFERENCE PERFORMANCE OBJ |
|---|---|---|---|---|
| | 13. | Mount system in/out physical support | E | 59 |
| | 14. | Adjust drive mechanism | E | 60 |
| | 15. | Adjust tape reader | E | 61 |
| | 16. | Record meter readings | E | 62 |
| | 17. | Splice wires | E | 63 |
| | 18. | Solder/unsolder components | E | 64 |
| | 19. | Keep maintenance records | E | 65 |
| E | | REPLACING COMPONENTS | | |
| | 1. | Replace cathode ray tube | E | 66 |
| | 2. | Replace capacitor | E | 67 |
| | 3. | Replace digital display segment | E | 68 |
| | 4. | Replace deflection yoke | E | 69 |
| | 5. | Replace energy storage cells | E | 70 |
| | 6. | Replace air filter | E | 71 |
| | 7. | Replace modular sub-assemblies | E | 72 |
| | 8. | Replace fuse and/or indicator lamps | E | 73 |
| | 9. | Replace IC chips | E | 74 |
| | 10. | Replace PC boards | E | 75 |
| | 11. | Replace photo-electric relays | E | 76 |
| | 12. | Replace pulley belt | E | 77 |
| | 13. | Replace tape head | E | 78 |
| | 14. | Replace klystron | E | 79 |
| F | | ADMINISTERING PERSONNEL | | |
| | 1. | Report equipment related safety violations | E | 80 |
| | 2. | Administer diagnostic tests to prospective employees | A | 81 |
| | 3. | Develop lesson plan for instruction/demonstration | A | 82 |
| | 4. | Conduct instruction by demonstration/performance | A | 83 |
| | 5. | Self evaluate performance | E | 84 |
| | 6. | Evaluate employee performance | A | 85 |
| | 7. | Evaluate training programs | A | 86 |
| | 8. | Interview prospective employees | A | 87 |
| | 9. | Monitor programmed instructions | A | 88 |
| | 10. | Orient personnel to procedures | A | 89 |
| | 11. | Plan work schedules | A | 90 |

## Performance Objectives

## DUTY A: ADJUSTING/ALIGNING/CALIBRATING ELECTRONIC CIRCUITRY

1. **TASK:** Adjust AC Signal Source Output

**LEVEL:** Entry

1) PERFORMANCE OBJECTIVE

Given the tools and equipment listed and an AC signal source whose output is out of tolerance, adjust the signal source output, (voltage, current, or frequency) to the design specifications of the circuit.

TOOLS AND EQUIPMENT

Screwdriver, blade, assorted
Screwdriver, phillips head, assorted
Wrench, socket set, assorted nut drivers
Voltmeter, AC
Current meter, AC
Frequency meter
Signal source

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to generator output controls.
3. Connect meter (volt, frequency, current) to output.
4. Apply dummy load to circuit.
5. Energize circuit.
6. Manipulate controls for desired output.
7. Check meter readings.
8. Deenergize circuit.
9. Remove dummy load.
10. Disconnect equipment.
11. Replace access panels.
12. Check for normal operation.

2. **TASK:** Adjust Amplifier Gain

**LEVEL:** Entry

2) PERFORMANCE OBJECTIVE

Given the tools and equipment listed and an amplifier in need of adjustment, adjust the amplifier gain so that it is within range of the design specifications.

TOOLS AND EQUIPMENT

Signal generator
Output measuring device
Adjustment tool
Transformer, isolation

PERFORMANCE GUIDE

1. Identify amplifier gain specifications.
2. Deenergize equipment.
3. Connect calibrated signal generator to amplifier input.
4. Connect test equipment to amplifier output.
5. Energize amplifier and test equipment.
6. Adjust gain control to input/output specifications.
7. Turn off amplifier, disconnect test equipment.
8. Check for normal operations.

3. **TASK:** Adjust Audio Level

**LEVEL:** Entry

3) PERFORMANCE OBJECTIVE

Given an audio circuit with the audio level in need of adjustment, and the tools and equipment necessary, adjust the audio intensity. When adjusted, the audio intensities will conform to the design specifications of the circuit.

TOOLS AND EQUIPMENT

Adjustment tools
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Signal generator, audio
Detector, audio output

PERFORMANCE GUIDE

1. Deenergize system.
2. Obtain access to circuit.
3. Locate audio intensity adjustment controls.
4. Connect audio input signal.
5. Connect audio output detector.
6. Energize system and test equipment.
7. Adjust audio intensity control.
8. Deenergize equipment.
9. Disconnect test devices.
10. Replace access covers, panels, etc.
11. Check for normal operation.

4. **TASK:** Adjust Feedback (AGC) Circuit

**LEVEL:** Entry

4) PERFORMANCE OBJECTIVE

Given an AGC circuit in need of adjustment and the tools and equipment listed, adjust the AGC circuit. When adjusted, the AGC circuit will conform to circuit design specifications.

TOOLS AND EQUIPMENT

Adjustment tools
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Signal generator, RF
Detector, RF output

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to AGC circuit.
3. Locate AGC controls.
4. Connect input signal.
5. Connect output detector.
6. Energize system/equipment.
7. Manipulate controls to proper output signal.
8. Deenergize system/equipment.
9. Disconnect test equipment.
10. Replace access covers, panels, etc.
11. Check for normal operations.

5. **TASK:** Adjust Bias Network

**LEVEL:** Entry

5) PERFORMANCE OBJECTIVE

Given a bias network and the tools and equipment listed, adjust the bias network. When adjusted, the voltage, current, and the impedance of the bias network will conform to design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, open end, assorted
Wrenches, socket set, with not drivers
Generator, input signal
Indicator, output

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to bias network.
3. Locate bias network adjustment controls.
4. Connect input signal generator.
5. Connect output detector to bias network.
6. Energize system/equipment.
7. Make adjustments.
8. Deenergize system/equipment.
9. Make adjustments.
10. Deenergize system/equipment.
11. Disconnect test equipment.
12. Replace access covers, panels, etc.
13. Check for normal operations.

6. **TASK:** Adjust Capacitance

**LEVEL:** Entry

6) PERFORMANCE OBJECTIVE

Given an electronic circuit with capacitance not within circuit design specifications and the tools and equipment listed, adjust the capacitance. When adjusted, the capacitance will be within the range of design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, open end, assorted
Wrenches, socket set, with nut drivers
Adjustment tools
Meter, capacitance
Indicator, output
Generator, input signal

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to capacitor.
3. Locate adjustment controls.
4. Identify tuning specifications.
5. Connect input signal generator.
6. Connect output indicator.
7. Energize system/equipment.
8. Make adjustments.
9. Deenergize system.
10. Disconnect test equipment.
11. Replace access covers, panels, etc.
12. Check for normal operations.

7. **TASK:** Adjust Core of Slug Tuned Circuits

**LEVEL:** Entry

7) PERFORMANCE OBJECTIVE

Given the tools and equipment listed and a slug tuned circuit with a core requiring adjustment, adjust the core of the slug tuned circuit. When adjusted, the output of the slug tuned circuit will meet design.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, open end, assorted
Adjustment tools
Indicator, output
Generator, input signal

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to circuit.
3. Locate slug tuned cores.
4. Connect output indicator.
5. Energize system/equipment.
6. Make adjustments.
7. Deenergize system/equipment.
8. Disconnect test equipment.
9. Replace access covers, panels, etc.
10. Check for normal operations.

8. **TASK:** Adjust Power Supply Output

**LEVEL:** Entry

8) PERFORMANCE OBJECTIVE

Using the tools and equipment listed and a power supply requiring adjustment, adjust the generator. When adjusted, the power supply output level for current and voltage will be within the circuit design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrench, socket set, assorted nut drivers
Voltmeter
Current meter
Power supply, input signal

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to power supply controls.
3. Connect voltmeter and/or current meter to output.
4. Apply dummy load to power supply.
5. Energize circuit.
6. Make adjustments.
7. Deenergize circuit.
8. Remove dummy load.
9. Connect power supply output to circuit.
10. Energize circuit.
11. Check power supply output.
12. Deenergize system/equipment.
13. Disconnect voltmeter.
14. Replace access covers, panels, etc.
15. Check for normal operations.

9. **TASK:** Adjust Focus Control

**LEVEL:** Entry

9) PERFORMANCE OBJECTIVE

Given the tools and equipment listed and an out-of-focus video screen, adjust the video. When adjusted, the video image will be sharp, clear, in focus with no distortion.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrench, adjustable
Adjustment tool
VOM/with high voltage probe
Mirror

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to video focus control.
3. Energize system.
4. Make adjustments.
5. Deenergize system.
6. Replace access panels, covers, etc.
7. Check for normal operations.

10. **TASK:** Adjust Linearity (Vertical, Horizontal)

**LEVEL:** Entry

10) PERFORMANCE OBJECTIVE

Given a video screen whose vertical and horizontal linearity are out of adjustment, adjust the linearity controls. When adjusted, the lines of resolution will be evenly spaced on the displayed cross hatch pattern.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted.
Screwdrivers, phillips head, assorted.
Adjustment tool.
Generator, color bar, cross hatch, DOT.
NTSC test pattern generator.
Mirror.

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to adjustment controls.
3. Locate/identify horizontal and vertical linearity controls.
4. Connect color bar generator or NTSC test pattern to input lead of video circuit.
5. Energize system/equipment.
6. Make adjustments.
7. Deenergize system/equipment.
8. Disconnect test equipment.
9. Replace access panels, covers, etc.
10. Check for normal operations.

11. **TASK:** Adjust Impedance

**LEVEL:** Entry

11) PERFORMANCE OBJECTIVE

Given an electronic circuit requiring impedance adjustment, adjust the impedance. When adjusted, the impedance will conform to design specifications of the circuit.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Adjustment tool
Generator, signal
Output measuring device

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to the circuit.
3. Locate impedance adjustment controls.
4. Connect signal generator to input lead.
5. Connect output measuring device.
6. Energize system/equipment.
7. Adjust as necessary.
8. Deenergize system/equipment.
9. Disconnect test equipment.
10. Replace access panels, covers, etc.
11. Check for normal operations.

12. **TASK:** Adjust Modulation Percentage

**LEVEL:** Entry

12) PERFORMANCE OBJECTIVE

Given a transmitter with a modulation percentage not meeting or exceeding tolerances, adjust the modulation. When adjusted, the modulation percentage will meet the design specification of the transmitter and FCC regulations.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, socket set, nut drivers
Wrenches, hex
Adjustment tools
Generator, signal input
Output measuring device

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to transmitter circuit.
3. Locate modulation controls.
4. Connect input generator to input to transmitter.
5. Connect output measuring device.
6. Energize system/equipment.
7. Make adjustments.
8. Deenergize system/equipment.
9. Disconnect test equipment.
10. Replace access panels, covers, etc.
11. Check for normal operations.

13. **TASK:** Adjust Oscillator

**LEVEL:** Entry

13) PERFORMANCE OBJECTIVE

Using tools and equipment listed, adjust an oscillator. When adjusted, the oscillator's frequency, amplitude, distortion, and phase characteristics will conform to the design specifications.

TOOLS AND EQUIPMENT

Adjustment tool, insulated
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Frequency measuring device with leads
Amplitude measuring device with leads
Oscilloscope with compensated probe

PERFORMANCE GUIDE

1. Determine oscillator frequency, amplitude, and wave shape characteristics from design specifications.
2. Deenergize system.
3. Gain access to oscillator.
4. Locate adjustment controls.
5. Connect calibrated frequency measuring device to the oscillator output.
6. Connect output amplitude measuring device to the oscillator output.
7. Connect an oscilloscope to the oscillator output.
8. Energize system/equipment.
9. Make adjustments.
10. Deenergize system/equipment.
11. Disconnect test equipment.
12. Replace access panels, covers, etc.
13. Check for normal operations.

14. **TASK:** Adjust Output of High Frequency Amplifiers

**LEVEL:** Entry

14) PERFORMANCE OBJECTIVE

Given an electronic circuit containing a high frequency amplifier requiring adjustment and the tools and equipment listed, adjust the amplifier. When adjusted, the output of the high frequency amplifier will conform to the design specifications of the circuit.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, socket set, nut drivers
Adjustment tools, insulated
Indicator, input
Signal source, input signal
Output measuring device

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to high frequency amplifier.
3. Locate adjustment controls.
4. Identify amplifier specifications.
5. Connect input signal generator.
6. Connect output measuring device.
7. Energize system/equipment.
8. Maker adjustments.
9. Deenergize equipment.
10. Disconnect test equipment.
11. Replace access panels, covers, etc.
12. Check for normal operations.

15. **TASK:** Adjust Test Equipment Calibrator Signal

**LEVEL:** Entry

15) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, adjust test equipment calibrator signal. When adjusted, the calibrator signal will meet design specifications.

TOOLS AND EQUIPMENT

Alignment tool
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrench, adjustable
Wrenches, hex
Output measuring device

PERFORMANCE GUIDE

1. Determine test equipment calibrator signal design.
2. Deenergize system.
3. Gain access to adjustment controls.
4. Connect output measuring device calibrator.
5. Energize system/equipment.
6. Make adjustments.
7. Deenergize system/equipment.
8. Disconnect test equipment.
9. Check for normal operations.

16. TASK: Adjust Voltage

LEVEL: Entry

16) PERFORMANCE OBJECTIVE

Given an electronic circuit whose voltage requires adjustment and the tools and equipment listed, adjust the voltage. When adjusted, the voltage level will conform to the design specifications of the circuit.

TOOLS AND EQUIPMENT

Adjustment tool
Voltmeter
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrench, adjustable

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to the circuit.
3. Locate voltage adjustment controls.
4. Connect voltmeter to voltage test point.
5. Energize system/equipment.
6. Make voltage adjustments.
7. Deenergize system/equipment.
8. Disconnect test equipment.
9. Replace access panels, covers, etc.
10. Check for normal operations.

17. TASK: Calibrate P-P Voltage

LEVEL: Entry

17) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, calibrate the P-P voltage of a circuit. When calibrated, the P-P voltage will conform to the design specifications of the circuit.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Adjustment tool
Oscilloscope, calibrated

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to the circuit.
3. Locate the P-P voltage controls.
4. Connect oscilloscope to output point.
5. Energize system/equipment.
6. Make adjustments.
7. Deenergize system/equipment.
8. Disconnect equipment.
9. Replace access panels, covers, etc.
10. Check for normal operations.

18. **TASK:** Calibrate Timing/Clock Pulse

**LEVEL:** Entry

18) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, calibrate the timing clock pulse of a digital timing circuit. When calibrated, the timing/clock pulse frequency and amplitude will meet the design specifications of the circuit.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrench, adjustable
Oscilloscope, calibrated (horizontal and vertical)

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to the digital timing circuit.
3. Locate adjustment controls.
4. Connect oscilloscope to output point.
5. Energize system/equipment.
6. Make adjustments.
7. Deenergize system/equipment.
8. Replace access panels, covers, etc.
9. Check for normal operations.

19. TASK: Adjust Tape Reader

LEVEL: Retention

19) PERFORMANCE OBJECTIVE

Using the tools and equipment listed and a tape reader requiring adjustment, adjust the tape reader. When adjusted, the tape reader will be free of all foreign material, the output from each channel will be within specified values, and the tape will not bind or tear when passing through the reader.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, Allen
Wrenches, socket set, assorted nut drivers
Cleaning solution
Applicator
Rags
Swabs, cotton
Tape, test
Voltmeter
Oscilloscope
Probe, demagnetized

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to tape head.
3. Locate adjustment controls.
4. Demagnetize heads.
5. Clean head and drive components.
6. Adjust mechanical tension arm.
7. Place test tape on reader.
8. Connect output reading device.
9. Energize system/equipment.
10. Adjust spooler and real for ease of operation.
11. Make adjustments for each channel.
12. Deenergize system/equipment.
13. Disconnect test equipment.
14. Remove test tape.
15. Replace access panels, covers, etc.
16. Check for normal operations.

20. **TASK:** Adjust Resonant Frequency

**LEVEL:** Retention

20) PERFORMANCE OBJECTIVE

Using the tools and equipment listed and an electronic circuit requiring a resonant frequency adjustment, adjust the resonant frequency. When adjusted, the resonant frequency of the circuit will conform to its design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, open end, assorted
Wrenches, socket set, with nut drivers
Adjustment tool
Indicator, output
Generator, input signal
Counter, frequency

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to circuit.
3. Locate frequency adjustment controls.
4. Connect input signal indicator.
5. Connect output indicator.
6. Energize system/equipment.
7. Make adjustments.
8. Deenergize system/equipment.
9. Disconnect test equipment.
10. Replace access panels, covers, etc.
11. Check for normal operations.

21. **TASK:** Adjust Armature Field Voltage

**LEVEL:** Advancement

21) PERFORMANCE OBJECTIVE

Given a motor/generator with an out of adjustment armature/field voltage, adjust the armature/field voltage will be within the range of the design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, open end, assorted
Wrenches, socket set, with nut drivers
Voltmeter
Ammeter

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to armature/field connection.
3. Connect test equipment to output line.
4. Locate armature/field voltage adjustment control.
5. Energize circuit and test equipment.
6. Adjust armature/field voltage.
7. Deenergize equipment and test equipment.
8. Disconnect test equipment.
9. Replace access devices.
10. Check for normal operation.

## DUTY B: DESIGNING EQUIPMENT AND CIRCUITRY

1. **TASK:** Conduct Physical Inventory

**LEVEL:** Entry

22) PERFORMANCE OBJECTIVE

Given the requirement to inventory an area for specified tools or equipment, conduct a physical inventory of the area. When the inventory is complete, all tools and equipment will be accounted for and included in an up-to-date inventory list.

TOOLS AND EQUIPMENT

List, tool
List, equipment
Pen/pencil
Clipboard
File, receipt, hand
Form, inventory

PERFORMANCE GUIDE

1. Obtain inventory lists for tools and equipment.
2. Become familiar with storage areas for tools and equipment.
3. Match each tool to tool inventory list. Note deviations.
4. Match each piece of equipment to the equipment inventory list. Note deviations.
5. Add tools and equipment not noted on the inventory list.
6. Identify tools and equipment identified on the equipment list which cannot be located physically or cannot be accounted for by receipt.
7. Update inventory list.

2. **TASK:** Construct External Interface Adapters

**LEVEL:** Entry/Retention/Advancement

23) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, construct external interface adapters for prototype electronic modules. When constructed, the external interface adapters should be mechanically compatible providing a tight fit with no looseness, and the adapters should not compromise the electronic data between modules.

TOOLS AND EQUIPMENT

Snips, tin
Cutters, wire
Strippers, wire
Cable, electronic
Metals
Wood
Plastic
Clamps
Drill, with assorted bits
Punches, assorted
Guides, drill
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Screws, assorted
Glue
Iron, soldering
Solder, resin core
Saw, coping
Hammer
Tape, measuring
Vise
Files, assorted
Hacksaw
Reamer
Washers, lock
Wire ties

PERFORMANCE GUIDE

1. Identify adapter specifications from blueprint/designer modules.
2. Identify type of connectors, fixtures, and/or materials needed.
3. Layout scribe lines for cutting, drilling, and fabricating raw materials.
4. Fabricate adapter sections.
5. Mount hardware/modules.
6. Secure adapter mountings to chassis.
7. Connect wire or cabline to chassis.
8. Connect to adapters.

3. **TASK:** Construct Tables Displaying Electronic Data (Variables, Parameters)

**LEVEL:** Entry

24) PERFORMANCE OBJECTIVE

Given data and measurements recorded from various electronic circuits and the tools and equipment listed, construct tables to display this electronic data. When displayed, the data will be accurate, clear, and uncluttered.

TOOLS AND EQUIPMENT

Pencils, assorted colors
Paper, graph
Erasers
Straight edge
Tape, adhesive, clear

PERFORMANCE GUIDE

1. Obtain recorded data.
2. Review data to develop scheme for graph.
3. Identify time lines/vertical/horizontal components.
4. Sketch rough draft.
5. Delete or make additions to draft.
6. Include pertinent information in reference list.
7. Add title to graph.
8. Transfer draft to graph paper to complete table.

4. TASK: Design Physical Support Hardware for New Electronic Equipment

LEVEL: Entry

25) PERFORMANCE OBJECTIVE

Given newly designed or prototype electronic equipment and the tools and equipment listed, design the physical support hardware for the equipment. When completed, the design will accommodate the unique characteristic of the prototype equipment.

TOOLS AND EQUIPMENT

Kit, drafting
Table, drafting
Pen
Pencils
Erasers
Edge, straight
Templates, electronic equipment

PERFORMANCE GUIDE

1. Review design specifications and intent of new hardware.
2. Review physical size and other physical peculiarities of equipment.
3. Compare stock items with design support required.
4. Design physical support hardware on rough draft. (Use stock items when and where practicable.)
5. Compare design with hardware specifications.
6. Transfer to final draft.
7. Check final draft of design for accuracy and neatness.

5. **TASK:** Draw Schematic of Circuitry

**LEVEL:** Entry/Retention/Advancement

26) PERFORMANCE OBJECTIVE

Given a rough drawing of an electronic circuit and the tools and equipment listed, draw a schematic of the circuit. When completed, the schematic will use standardized symbols, designations, conventions, and accurately depict circuit functions.

TOOLS AND EQUIPMENT

Kit, drafting
Table, drafting
Pen
Pencils
Erasers
Edge, straight
Templates, electronic equipment

PERFORMANCE GUIDE

1. Review rough draft of schematic.
2. Layout schematic.
3. Make preliminary draft.
4. Review preliminary draft making additions and deletions.
5. Sketch final draft.
6. Check for accuracy and neatness.

6. **TASK:** Prepare a Parts List for Prototype Equipment

**LEVEL:** Entry

27) PERFORMANCE OBJECTIVE

Given a schematic for the development of prototype equipment and the equipment listed, prepare a parts list for that equipment. When completed, the parts list will contain all of the parts which make up the equipment.

TOOLS AND EQUIPMENT

Prototype schematic
Inventory, parts
Catalog, parts reference
Pencils
Papers
Erasers

PERFORMANCE GUIDE

1. Review prototype schematic.
2. List parts required to fabricate equipment.
3. Compare parts lists to parts catalog.
4. Determine parts needed.
5. List parts required identifying parts in stock and parts to be purchased or fabricated.
6. Include on special procurement information modifications of fabrications in notes.

7. **TASK:** Translate Graphic Information Into Written Specifications

**LEVEL:** Entry

28) PERFORMANCE OBJECTIVE

Using the equipment listed and graphic information from technical manuals, translate the graphic information (i.e., block diagram bell curve) into written specifications. When completed, the written specifications will be an exact translation of the graphic information.

TOOLS AND EQUIPMENT

Technical data in graphic form
Pencils
Paper
Erasers

PERFORMANCE GUIDE

1. Review technical data instructions.
2. Determine specific technical data to be removed.
3. List technical data as depicted by graphs.
4. Combine information into written steps.
5. Check for accuracy and continuity.

8. **TASK:** Write Operational Procedures

**LEVEL:** Entry

29) PERFORMANCE OBJECTIVE

Using the equipment listed and a system of operating procedures, write the operational procedures for the system. When completed, the operating procedures will include all sequential steps necessary to operate the system.

TOOLS AND EQUIPMENT

Design specifications
Pencils
Paper
Erasers
Equipment, system support

PERFORMANCE GUIDE

1. Review design specifications requirements.
2. Review all supportive equipment necessary to operate system.
3. Observe procedures.
4. Perform procedures.
5. List all procedures required.
6. Sequence procedures.
7. Supplement sequenced procedures with additional procedures (when and where necessary).
8. Try out procedures.
9. Make necessary deletions, additions, etc.

9. **TASK:** Write Summary Report of Operational Tests

**LEVEL:** Entry/Retention/Advancement

30) PERFORMANCE OBJECTIVE

Using the equipment listed, write a summary report of operational tests. When completed, the summary report will briefly, accurately, and sequentially describe the operational tests.

TOOLS AND EQUIPMENT

Reports, operational test
Pencils/pens
Paper
Eraser
Manual, technical
Dictionary

PERFORMANCE GUIDE

1. Review all operational tests.
2. Determine sequence of tests.
3. Summarize each operation test.
4. Check data by use of technical manuals and/or experts.
5. Sequentially summarize summaries of each test.
6. Read for continuity, conciseness, and clarity.
7. Make necessary corrections.
8. Prepare final draft of summary report of operational tests.

10. **TASK:** Design Circuits From Engineering Specifications

**LEVEL:** Entry

31) PERFORMANCE OBJECTIVE

Given the engineering specifications for a circuit, design the circuit using the specifications. When completed, the design circuit will be accurate, neat, and not compromise the intent of the design.

TOOLS AND EQUIPMENT

Specifications, engineer's
Pencil/pen
Paper
Eraser
Edge, straight
Template, electronic symbols

PERFORMANCE GUIDE

1. Review the specifications.
2. Review the design intent.
3. Sketch circuitry.
4. Compare circuitry with specifications.
5. Make adjustments.
6. Prepare final design.

11. **TASK:** Plan Quality Assessment Checks (Physical, Electrical)

**LEVEL:** Retention

32) PERFORMANCE OBJECTIVE

Given an electronic assembly line with varying stages of assembly in process and the tools and equipment listed, plan quality assessment checks at critical points along the line. When completed, the plan will provide for quality control assessment at all critical points of the assembly line.

TOOLS AND EQUIPMENT

Watch, stop
Roster, work
Product construction schematic (assembly, subassembly, final product)
Job descriptions
Product specifications (assembly, subassembly, final product)
Time-motion study sheets
Pencils
Paper
Erasers

PERFORMANCE GUIDE

1. Review production schematic from parts layout to assembly to subassembly to final product.
2. Review specifications, time, and/or quality of subassemblies.
3. Review reports citing areas with most breakdowns.
4. Identify specific areas where quality control checks can be set up.
5. Develop plan using quality control checkpoints, break-down statistics, and assembly areas most suited for checks.

12. **TASK:** Prepare an Estimate of Production Time

**LEVEL:** Advancement

33) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, prepare an estimate of production time for a particular piece of equipment. When completed, the production estimate will be supported by factual data and will identify time centers.

TOOLS AND EQUIPMENT

Pencils
Paper
Stop-watch
Production records of similar jobs
Calculator

PERFORMANCE GUIDE

1. Determine by time study sheets, written specifications, and/or observations actual time necessary to perform all subassemblies.
2. Use sampling intervals to collect data.
3. Estimate operator efficiency, application, and skill.
4. Compute estimated averages for production time.
5. Statistically analyze all data collected.
6. Cross-check results with production records of similar jobs.

13. **TASK:** Draft Preliminary Specifications for an Electronic Device

**LEVEL:** Advancement

34) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, draft preliminary specifications for an electronic device. When completed, the specifications will conform to the design of the electronic device and the circuit for which it will be used.

TOOLS AND EQUIPMENT

Schematic, design
Circuitry, design
Specifications, design
Circuit requirements

PERFORMANCE GUIDE

1. Review design specifications of the electronic device.
2. Determine tolerances for circuit.
3. Review design specifications of the circuit.
4. Determine circuit specifications.
5. Compare specifications of the circuit with those of the design.
6. Draft preliminary specifications based on the comparison of specifications for the circuit and the device.

14. **TASK:** Design Interfaces Between Subassemblies (Electrical, Mechanical)

**LEVEL:** Advancement

35) PERFORMANCE OBJECTIVE

Given an electronic circuit that requires unique electrical terminations and the tools and equipment listed, design electrical terminations for the equipment. When completed, the design will provide for uncomplicated, easy-to-assemble interfaces which will not compromise circuit design.

TOOLS AND EQUIPMENT

Kit, drafting
Table, drafting
Pen
Pencils
Erasers
Edge, straight
Templates, electronic equipment

PERFORMANCE GUIDE

1. Review design specifications of circuit.
2. Review chassis or assembly where interfaces are to be attached.
3. Review connectors/interfaces in stock.
4. Design interfaces (modify and adapt to existing equipment when possible).
5. Compare interface design and design specifications of the circuit.

15. **TASK:** Assist in Verification of Preliminary Designs

**LEVEL:** Entry

36) PERFORMANCE OBJECTIVE

Given the preliminary engineering documentation of an electronic circuit, check all art work for errors and debug the circuit according to design specifications.

TOOLS AND EQUIPMENT

Engineering documents
Pen/pencil
Paper

PERFORMANCE GUIDE

1. Review the document.
2. Review the design intent.
3. Check art work for errors.
4. Compare circuitry with design specifications.
5. Document all errors found.

16. **TASK:** Input Engineering Documentation

**LEVEL:** Retention

37) PERFORMANCE OBJECTIVE

Given engineering documentation (i.e., schematic) and a graphics/word processing work station, prepare a users manual according to industry standards.

TOOLS AND EQUIPMENT

Engineering documents
Graphics/word processing work station
Printer

PERFORMANCE GUIDE

1. Review the document.
2. Review the design intent.
3. Write user manual for procedures.
4. Test manual for accuracy.

17. **TASK:** Write Program(s)

**LEVEL:** Advancement

38) PERFORMANCE OBJECTIVE

Given a schedule, specifications, and computer integrated test equipment, write a software program that will diagnose equipment and circuits according to engineering specifications.

TOOLS AND EQUIPMENT

Schedule
Engineering documents
Computer integrated test equipment
Computer
Storage diskettes

PERFORMANCE GUIDE

1. Review engineering documents.
2. Review design intent.
3. Review specifications.
4. Write software program to diagnose equipment and circuits.
5. Test software for accuracy.
6. Re-key if necessary

18. **TASK:** Read and Interpret Diagrams

**LEVEL:** Entry

39) PERFORMANCE OBJECTIVE

Given an engineering document (schematic, design), correctly follow the proposed specifications. When completed, the design circuit will be accurate, neat, and not compromise the intent of the design.

TOOLS AND EQUIPMENT

Engineering documents
Pencil/pen
Paper

PERFORMANCE GUIDE

1. Review the document.
2. Review the design intent.
3. Compare circuitry with specifications.

19. TASK: Read and Interpret Flowcharts

LEVEL: Entry

40) PERFORMANCE OBJECTIVE

Given an engineering document, read and interpret the flowcharts. When completed, the design will be accurate, neat, and not compromise the intent of the design.

TOOLS AND EQUIPMENT

Engineering documents
Pencil/pen
Paper

PERFORMANCE GUIDE

1. Review the document.
2. Review the design intent.
3. Document changes recommended.

20. TASK: Document Daily Activities

LEVEL: Entry

41) PERFORMANCE OBJECTIVE

Given engineering notebook, document all daily activities, product concerns, data, charts, and instructions.

TOOLS AND EQUIPMENT

Engineering notebook
Pencil/pen
Eraser

PERFORMANCE GUIDE

1. Review days' activities.
2. Record days' activities.
3. Turn in to supervisor, engineering notebook.

## DUTY C: PERFORMING ENVIRONMENTAL TESTS

1. TASK: Perform Temperature Test

LEVEL: Entry

42) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, perform a temperature test on an electronic circuit/module. When completed, the circuit/module performance under temperature extremes will be recorded.

TOOLS AND EQUIPMENT

Circuit/module specifications
Chamber, test, climatically controlled
Recording graph, temperature
Timing device
Input measuring device
Generator, signal, input
Output measuring device
Pliers, needle nose
Wrenches, open end, assorted
Gun, soldering
Solder, resin core
Pencils/pens
Information sheets
Paper, graph
Erasers
Heat gun (hair dryer)

PERFORMANCE GUIDE

1. Review circuit/module specifications.
2. Determine temperature parameters of climatic test chamber.
3. Install circuit/module in test chamber.
4. Connect output measuring device.
5. Connect input signal generator.
6. Connect temperature monitoring device to circuit/module.
7. Energize system.
8. Adjust temperatures as desired.
9. Record results.

2. TASK: Perform Corrosive Test

LEVEL: Retention

43) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, perform a corrosive test on an electronic circuit. When completed, the test will have exposed the circuit to all potential forms of corrosion and recorded the results of each test.

TOOLS AND EQUIPMENT

Information sheets
Chamber, climatically controlled
Recording graph, time, voltage
Clock
Specifications, corrosion
Metals, test
Input measuring device
Output measuring device
Generator, signal
Brush, wire
Pliers, needle nose
Pliers
Wrenches, open end, assorted
Gun, soldering
Solder, acid core
Gloves, rubber
Glasses, safety

PERFORMANCE GUIDE

1. Review corrosion specifications.
2. Set up test apparatus according to specifications.
3. Set up test area (climatic chamber).
4. Connect input measuring device.
5. Connect output measuring device.
6. Connect time controlled graph recording.
7. Overlay two dissimilar pieces of metal to form an electric connection for current to pass through (intermetallic). For granular corrosion check use only one piece of test metal.
8. Connect input voltage.
9. Energize system and equipment.
10. Record results.

3. TASK: Perform Maximum Power Test

LEVEL: Retention

44) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, perform a maximum power test on a circuit. When completed, the test will have identified the maximum power the circuit will withstand and still function.

TOOLS AND EQUIPMENT

Input signal, variable
Paper, graph
Pencil/pen
Clock
Information sheets
Transformer, isolation
Test area
Power recording device
Wrenches, open end, assorted
Gun, soldering
Solder, resin core

PERFORMANCE GUIDE

1. Review specifications of the circuit.
2. Build test stand in test area.
3. Connect input signal to circuit.
4. Connect output signal to circuit.
5. Connect recording devices, time, and power to circuit.
6. Energize circuit and equipment.
7. Gradually increase input signal (power) until circuit overloads, ceases to function, or functions abnormally.
8. Record results.

4. **TASK:** Perform Pressure Test

**LEVEL:** Retention

45) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, perform a pressure test on an electronic circuit. When completed, the test will have identified the range of pressures to which the circuit will be exposed.

TOOLS AND EQUIPMENT

Circuit specifications
Chamber, test, climatically controlled
Recording graph
Generator, signal, input
Output measuring device
Wrenches, open end, assorted
Gun, soldering
Solder, resin core
Pliers, needle nose

PERFORMANCE GUIDE

1. Review circuit specifications.
2. Determine parameters of climatic chamber.
3. Install circuit in chamber.
4. Connect recording device to circuit.
5. Connect output measuring device.
6. Connect input signal.
7. Seal chamber.
8. Energize circuit and equipment.
9. Initiate tests, vary pressure from low pressure to high pressure to simulate extreme conditions to which the circuit will be subjected.
10. Record results.

5. TASK: Perform Shock (Impact) and Vibration Test

LEVEL: Retention

46) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, perform a shock (impact) and vibration test on an electronic circuit or module. When completed, the test will record the ability of the circuit or module to withstand various impacts.

TOOLS AND EQUIPMENT

Circuit/module specifications
Wrenches, open end, assorted
Device, impact imparting (variable)
Pliers, needle nose
Gun, soldering
Solder, resin core
Timepiece
Recording graph
Pencils/paper
Information sheets
Eraser
Paper, graph
Output measuring device
Generator, input signal
Instrument, impact recording
Glasses, safety

PERFORMANCE GUIDE

1. Review circuit/module specifications.
2. Determine impact parameters to be tested.
3. Install circuit/module in test area.
4. Connect impact measuring device to system.
5. Connect circuit/module output measuring device.
6. Connect input signal generator.
7. Turn on system.
8. Activate impact imparting device.
9. Record results.

DUTY D: MAINTAINING ELECTRONIC DEVICES

1. TASK: Assemble Structural Members

LEVEL: Entry

47) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, assemble structural members according to a drawing of the structure. When completed, the structure will be assembled with structural members in place according to the assembly drawing.

TOOLS AND EQUIPMENT

Wrenches, open end, assorted
Wrench, adjustable
Hammer
Pliers
Pliers, needle nose
Cutters, wire
Strippers, wire
Connectors, terminal, assorted
Glasses, safety

PERFORMANCE GUIDE

1. Review assembly drawing.
2. Inventory parts.
3. Layout parts according to assembly sequence.
4. Assemble small members.
5. Assemble large members.
6. Combine large and small members according to suggested sequence.
7. Tighten assembly.
8. Replace tools and equipment.

2. TASK: Clean Air Filters

LEVEL: Entry

48) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, clean an air filter. Cleaning is complete when filter air flow is unimpeded and there are no visible signs of dirt or lint.

TOOLS AND EQUIPMENT

Flashlight
Screwdriver, blade, assorted
Cloth, wiping
Vacuum cleaner
Broom, whisk
Cleaning solution
Forced air (restricted pressure)
Cord, extension

PERFORMANCE GUIDE

1. Deenergize system.
2. Remove access panels.
3. Remove filter.
4. Perform cleaning activities.
5. Replace filter.
6. Replace access panels.
7. Energize system.
8. Test for performance.

3. TASK: Clean Chassis

LEVEL: Entry

49) PERFORMANCE OBJECTIVE

Given a dirty chassis and the tools and equipment listed, clean the chassis. When completed, there will be no visible signs of dirt or lint.

TOOLS AND EQUIPMENT

Wrenches, open end, assorted
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Cleaning solution
Vacuum cleaner with attachment
Forced air (restricted pressure)
Flashlight
Cord, extension
Cloth, wiping
Glasses, safety

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to chassis.
3. Remove loose dirt/lint.
4. Apply cleansing solution (allow time to soak).
5. Wipe out excess dirt.
6. Remove all excess dirt and lint.
7. Blow dry, if necessary.
8. Replace panels, covers.
9. Check operation.

4. **TASK:** Clean Circulation Fans

**LEVEL:** Entry

50) PERFORMANCE OBJECTIVE

Given an electronic circuit whose circulation fans need cleaning and the tools and equipment listed, clean the circulation fans. When completed, the fans will be free of any dirt, grease, or lint.

TOOLS AND EQUIPMENT

Wrenches, socket, assorted
Wrenches, Allen, assorted
Screwdrivers, blade, assorted
Screwdrivers, phillips, assorted
Flashlight
Vacuum cleaner with attachments
Cord, extension
Cloth, wiping
Cleaning solution
Forced air (restricted pressure)
Glasses, safety

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to fans.
3. Remove loose dirt/lint or grease from the fan.
4. Apply cleansing solution (allow time to soak).
5. Wipe off excess dirt, grease, and lint.
6. Remove all visible dirt, grease, and lint from fans and protective covers.
7. Blow dry, if necessary.
8. Replace panels, covers, etc.
9. Check operation of fans.

5. **TASK:** Clean Contact Points

**LEVEL:** Entry

51) PERFORMANCE OBJECTIVE

Given contact points requiring cleaning and the tools and equipment listed, clean the contact points. When completed, the contact points will be visually free of any dirt or corrosion and register minimum resistance between point surfaces.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Paper, bond, strips
Tool, burnishing
Forced air (restricted pressure)
Cleansing solution
Wrenches, socket, assorted
Wrenches, Allen, assorted
Flashlight
Cloth, wiping

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to points.
3. Clean per manufacturers specifications.
4. Replace panels, covers, etc.
5. Energize system.
6. Check operation of fans.

6. **TASK:** Clean Drive Mechanism

**LEVEL:** Entry

52) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, clean a drive mechanism. When clean, the drive mechanism will be free of any visible dirt, grease, or lint.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, hex, assorted
Wrenches, socket set
Cleansing solution
Cloth, wiping
Flashlight
Glasses, safety
Forced air, restricted flow

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to drive mechanism.
3. Wipe dirt, grease, lint from drive gears.
4. Remove excess cleaning solution from gears--blow dry if necessary.
5. Replace access covers, panels, etc.
6. Check operation.

7. **TASK:** Clean Reflector Mirror and Lenses

**LEVEL:** Entry

53) PERFORMANCE OBJECTIVE

Using the tools and equipment listed and a tape reader with a dirty reflector mirror, clean the reflector mirror. When cleaned, the mirror surface will be free of dust and dirt and give a clear reflection of the light source.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Tissue, cleaning, photographer's lens
Cleaning solution (freon, alcohol, etc.)
Wrenches, open end, assorted
Flashlight
Cloth, wiping

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to mirror.
3. Clean as per manufacturers specifications.
4. Inspect for a clean dust-free surface.
5. Replace access panels, covers.
6. Energize system.
7. Check operation.

8. **TASK:** Clean Tape Head

**LEVEL:** Entry

54) PERFORMANCE OBJECTIVE

Given a tape that requires cleaning and the tools and equipment listed, clean the tape head. When cleaned, the tape head will be free of all traces of tape material, dirt, and lint.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Cloth, wiping
Swab, cotton, buckskin, or chamois
Cleaning solution
Flashlight
Probe, demagnetizing

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to tape head.
3. Demagnetize head.
4. Clean as per manufacturers specifications.
5. Energize system.
6. Check for peak performance.
7. Deenergize system.
8. Replace access panels, covers, etc.

9. **TASK:** Clean Tape Reader

**LEVEL:** Entry

55) PERFORMANCE OBJECTIVE

Given a tape reader and the tools and equipment listed, clean the tape reader. When cleaned, the tape reader will be free of foreign materials.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, Allen, assorted
Cleaning solution
Cloth, lint-free, wiping
Swabs, cotton
Wrenches, adjustable
Flashlight
Probe, demagnetizing

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to tape reader.
3. Demagnetize head.
4. Clean tape reader as per manufacturers specifications.
5. Replace access panels, covers, etc.
6. Energize equipment.
7. Check operation.

10. **TASK:** Clean Tuner

**LEVEL:** Entry

56) PERFORMANCE OBJECTIVE

Given a tuner requiring cleaning and the tools and equipment listed, clean the tuner so that the tuner provides a static-free, noise-free output.

TOOLS AND EQUIPMENT

Screwdrivers, blades, assorted
Screwdrivers, phillips head, assorted
Cloth, wiping
Cleaner, tuner
Eraser
Brush, wiping, small

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to the tuner. Note: Do not bend or dislocate parts or shields.
3. Clean as per manufacturers specifications.
4. Energize equipment.
5. Check operation.
6. Deenergize system.
7. Replace access panels, covers, etc.

11. **TASK:** Clean Potentiometer (Volume Control, Video, Chroma, etc.)

**LEVEL:** Entry

57) PERFORMANCE OBJECTIVE

Given an electronic circuit containing a potentiometer in need of cleaning and the tools and equipment necessary, clean the potentiometer. When cleaned, the potentiometer will register a smooth increase or decrease of resistance as shown on the ohmmeter.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, socket set
Wrenches, hex assorted
Wrench, adjustable
Cleaning solution or degreaser
Ohmmeter

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to potentiometer.
3. Clean as per manufacturer's specifications.
4. Energize system.
5. Check for noise-free operation.
6. Deenergize system.
7. Replace access panels, covers, etc.

12. **TASK:** Locate Component Malfunctions

**LEVEL:** Entry

58) PERFORMANCE OBJECTIVE

Using the fault location guides and the tools and equipment listed, identify defective components of an electronic circuit. When completed, the defective component(s) of the circuit will be located and identified.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, hex, assorted
Flashlight
VOM
Output measuring device
Guides, fault location

PERFORMANCE GUIDE

1. Identify test requirements from manufacturer's specifications.
2. Energize system and observe operation and symptoms.
3. Initiate process prescribed in fault location guides.
4. Continue process until decision(s) is/are made regarding location and identity of defective component(s).
5. Isolate defective components.
6. Identify defective components.

13. TASK: Mount System In/Out Physical Support

LEVEL: Entry

59) PERFORMANCE OBJECTIVE

Given an electronic circuit/module and a physical support, and the tools and equipment listed, mount the circuit/module in/on the physical support. When mounted, the circuit module will be physically secure and there will be no damage to the equipment or personnel.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, open end, assorted
Wrenches, hex, assorted
Hoist/lift device
Slings
Hooks, lift
Clamps

PERFORMANCE GUIDE

1. Secure system in preparation to hoist or lift.
2. Hoist system and position to mounting place.
3. Lower system in mounting place.
4. Install fasteners holding system to physical support.
5. Remove lifting device (straps, chains, clamps, etc.) from system.
6. Check for sturdiness and security.

14. TASK: Adjust Drive Mechanism

LEVEL: Entry

60) PERFORMANCE OBJECTIVE

Given a drive mechanism that is out of adjustment and the tools and equipment listed, adjust the drive mechanism. When adjusted, the drive mechanism will not slip, rattle, and the gear teeth will mesh without binding or chipping.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Wrenches, open end, assorted
Wrench, adjustable
Wrenches, hex
Punch set
Hammer
Glasses, safety
Oil, machine

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to the drive mechanism.
3. Locate adjustment controls.
4. Make adjustments.
5. Energize system.
6. Check system operation.
7. Deenergize system.
8. Replace access panels, covers, etc.
9. Check for normal operations.

15. TASK: Adjust Tape Reader

LEVEL: Entry

61) PERFORMANCE OBJECTIVE

Using the tools and equipment listed and a tape reader requiring adjustment, adjust the tape reader. When adjusted, the tape reader will be free of all foreign material, the output from each channel will be within specified values and the tape will not bind or tear when passing through the reader.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, Allen
Wrenches, socket set, assorted nut drivers
Cleaning solution
Applicator
Rags
Swabs, cotton
Tape, test
Voltmeter
Oscilloscope
Probe, demagnetized

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to tape head.
3. Locate adjustment controls.
4. Demagnetize heads.
5. Clean head and drive components.
6. Adjust mechanical tension arm.
7. Place test tape on reader.
8. Connect output reading device.
9. Energize system/equipment.
10. Adjust spooler and reel for ease of operation.
11. Make adjustments for each channel.
12. Deenergize system/equipment.
13. Disconnect test equipment.
14. Remove test tape.
15. Replace access panels, covers, etc.
16. Check for normal operations.

16. **TASK:** Record Meter Readings

**LEVEL:** Entry

62) PERFORMANCE OBJECTIVE

Given an electronic system containing meters requiring continuous monitoring, and the equipment listed, read and record the meter readings at specified time intervals. When recorded, the meter readings will reflect the actual indication of the meter at the time of the reading.

TOOLS AND EQUIPMENT

Pencil/pen
Recording sheet
Schedule, meter, reading
Flashlight
Watch
Clipboard

PERFORMANCE GUIDE

1. Review meter reading sheet.
2. Review schedule.
3. Determine an efficient pattern to be used to record meter readings.
4. Observe meter readings.
5. Record time, date, and reading on recording sheet.

17. **TASK:** Splice Wires

**LEVEL:** Entry

63) PERFORMANCE OBJECTIVE

Provide two wires and the tools and equipment listed, splice the wires. When spliced, the wires will be mechanically and electrically bonded; the insulation will not be frayed; the splice will not short out; and there will be no voltage drop across the splice.

TOOLS AND EQUIPMENT

VOM
Connectors, assorted
Pliers, crimp
Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Pliers, needle nose
Cutters, wire
Tape, electrical
Crimpers
Sleeves, splice
Iron, soldering
Solder, resin core
Strippers, wire

PERFORMANCE GUIDE

1. Deenergize system.
2. Splice wires using appropriate technique.
3. Tape for insulation.
4. Energize system.
5. Test performance.

18. **TASK:** Solder/Unsolder Components

**LEVEL:** Entry

64) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, solder a replacement electronic component into a circuit. When completed, the component can be integrated or removed from the circuit with no functional deterioration of the circuit, and no excess solder visible.

TOOLS AND EQUIPMENT

Cutters, wire
Stripper, wire
VOM
Gun, soldering
Flashlight
Brush, wire
Braid, soldering
Solvent, resin
Solder
Pliers, diagonal
Lacquer, spray
Glasses, safety

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Connect equipment using appropriate grounding procedures.
3. Connect heat sink to device.
4. Unsolder component and remove excess solder until component is free from circuit.
5. Remove component.
6. Clean circuit using solvent and brush.
7. Insert new component.
8. Install heat sink and necessary ground straps.
9. Solder component.
10. Remove heat sink and grounding straps.
11. Clean excess resin from circuit using brush and solvent.
12. Spray clean board with lacquer solution.

19. TASK: Keep Maintenance Records

LEVEL: Entry

65) PERFORMANCE OBJECTIVE

Given data on maintenance/repairs, document all service records accurately and legibly.

TOOLS AND EQUIPMENT

Engineers notebook
Pencil/pen
Repair records

PERFORMANCE GUIDE

1. Review maintenance records.
2. Document repair history; i.e., part, frequency down time, etc.

## DUTY E: REPLACING COMPONENTS

1. **TASK:** Replace Cathode Ray Tube

   **LEVEL:** Entry

   66) PERFORMANCE OBJECTIVE

   Given an electronic circuit containing a defective cathode ray tube, replace the cathode ray tube. When the tube is replaced, there will be no space between the rubber shock housing and the tube, and the tube will be geometrically aligned.

   TOOLS AND EQUIPMENT

   Screwdrivers, blade, assorted
   Screwdrivers, phillips head, assorted
   Wrenches, socket set with nut drivers
   Safety glasses
   Flashlight
   Wrenches, hex, assorted
   Gloves

   PERFORMANCE GUIDE

   1. Deenergize circuit.
   2. Gain access to cathode ray tube.
   3. Discharge tube.
   4. Disconnect socket and anode connections.
   5. Remove accessories from CRT.
   6. Remove supporting hardware.
   7. Remove defective CRT according to manufacturer's specifications.
   8. Install replacement CRT according to manufacturer's specifications.
   9. Install supporting hardware.
   10. Connect accessories to CRT.
   11. Connect wiring.
   12. Replace access panels, covers, etc.
   13. Energize circuit.
   14. Properly align CRT according to manufacturer's specifications.

   * Safety film on installation of CRT is available from Tektronics.

2. TASK: Replace Capicitor

LEVEL: Entry

67) PERFORMANCE OBJECTIVE

Given an electronic circuit containing a defective capacitor and the tools and equipment listed, replace the capacitor. When the capacitor is replaced, there will be no heat damage to the capacitor or circuit and the circuit will function according to design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Iron, soldering
Solder
Resin solvent
Sink, heat
Pliers, needle nose
Pliers, diagonal
Brush, wire
Light, extension
Cloth, wiping
Glasses, safety

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to capacitor.
3. Discharge capacitor.
4. Unsolder capacitor using heat sink as necessary.
5. Clean circuit using solvent and brush.
6. Clip and form leads of capacitor to fit.
7. Install capacitor in circuit observing polarity or outside foil markings as applicable.
8. Solder capacitor using heat sink as required.
9. Remove heat sink.
10. Clean excess solder.
11. Install equipment covers.
12. Energize circuit.
13. Check for normal operations.

3. **TASK:** Replace Digital Display Segment

**LEVEL:** Entry

68) PERFORMANCE OBJECTIVE

Given an electronic circuit containing a defective digital display segment and the tools and equipment listed, replace the digital display segment. When replaced, the segment's pin placement will be aligned and there will be no sign of heat or physical damage to the display segment and associated circuitry.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Puller, I.C.
Gun, soldering
Solder
Solvent, resin
Braid, soldering
Wrenches, Allen, assorted
Wrenches, socket set
Solder remover

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to digital display segment.
3. Locate defective segment.
4. Remove connectors on solder from segment.
5. Install replacement digital display segment.
6. Connect digital display segment to circuit. (Caution: If segment is to be soldered, use a small wattage soldering iron, do not make any soldering bridges.)
7. Energize system.
8. Test for operation.
9. Replace access panels, covers, etc.
10. Check for normal operations.

4. **TASK:** Replace Deflection Yoke

**LEVEL:** Entry

69) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, replace a deflection yoke. When replaced, the yoke will be mechanically secure around the cathode ray tube and be adjusted so as to respond to the full range of adjustment controls.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, socket set with nut drivers
Pliers
Pliers, needle nose
Flashlight
Coil, degaussing
Cloth, wipe
Cleaner, glass

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to deflection yoke.
3. Disconnect CRT socket.
4. Remove accessories (blue lateral magnet, convergence yoke, etc.
5. Remove deflection yoke.
6. Install replacement yoke.
7. Connect yoke plug.
8. Replace accessories.
9. Connect CRT socket.
10. Energize system.
11. Degauss CRT.
12. Test for performance.
13. Deenergize system.
14. Replace access panels, covers, etc.
15. Check for normal operations.

5. **TASK:** Replace Energy Storage Cells

**LEVEL:** Entry

70) PERFORMANCE OBJECTIVE

Given an electronic circuit containing defective energy storage cells and the tools and equipment listed, replace the energy storage cells. When replaced, the energy storage cells will be secure in their mountings, terminals will be free of corrosion and the voltage polarity of the cells will be observed.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, adjustable
Brush, wire
Cloth, wiping
Flashlight

PERFORMANCE GUIDE

1. Deenergize system. (Caution: When replacing energy storage cells, be able to observe all safety regulations.)
2. Gain access to energy storage cells.
3. Identify defective cells.
4. Remove electrical connections (positive lead first).
5. Remove energy storage cell.
6. Install replacement cell.
7. Connect electrical connections (negative lead first).
8. Replace access panels, covers, etc.
9. Test for performance.

6. TASK: Replace Air Filter

LEVEL: Entry

71) PERFORMANCE OBJECTIVE

Given an electronic circuit containing a defective air filter and the tools and equipment listed, replace the filter. When replaced, the filter will be mechanically secure and will be positioned to face the prescribed air flow directions.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, Allen
Wrenches, socket set
Flashlight
Cleaner, vacuum
Cloth, wiping

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to filter.
3. Remove filter.
4. Clean lint, dirt, dust or any other foreign material from around filter mounting.
5. Install replacement filter.
6. Replace access panels, covers, etc.
7. Test for performance.

7. **TASK:** Replace Modular Subassemblies

**LEVEL:** Entry

72) PERFORMANCE OBJECTIVE

Using the tools and equipment listed, replace a defective modular subassembly. When replaced, the converter will have secure mechanical and electrical connections and conform to the design specifications of the circuit.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, socket set with nut drivers
Wrenches, open end, assorted
Wrenches, Allen, assorted
Voltmeter
Counter, frequency

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to converter.
3. Mark and disconnect electrical connections.
4. Remove converter from mountings.
5. Install replacement converter. (Note: Observe motor generator shaft alignment.)
6. Make electrical connections conforming to markings made in Step 3.
7. Energize equipment.
8. Check frequency.
9. Deenergize equipment.
10. Replace access panels, covers, etc.
11. Check for normal operations.

8. **TASK:** Replace Fuse and/or Indicator Lamps

**LEVEL:** Entry

73) PERFORMANCE OBJECTIVE

Given an electronic circuit with a defective fuse and the tools and equipment listed, replace the fuse. When replaced and the fuse will fit securely in the fuse holder, be of same physical size and specifications and allow the current path to be complete.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, Allen, assorted
Wrenches, adjustable
Pullers, fuse
Fuses, assorted

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to fuse.
3. Locate defector fuse.
4. Remove fuse as per manufacturer's recommendations.
5. Install replacement fuse as per manufacturer's recommendations.
6. Replace access panels, covers, etc.
7. Energize system.
8. Check for normal operations.

9. **TASK:** Replace IC Chips

**LEVEL:** Entry

74) PERFORMANCE OBJECTIVE

Given an electronic circuit with a defective IC Chip and the tools and equipment listed, replace the IC chip. When replaced, there will be no damage to chip or the circuit and the chip will function according to the design specifications of the circuit.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Iron, soldering
Pot, soldering
Pliers, needle nose
Pliers, diagonal
Solvent, resin
Solder
Sink, heat
Straps, grounding
Brush, wire
Solder remover (vacuum)

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to chip.
3. Install heat sink and grounding straps as applicable.
4. Unsolder chip. (Caution: Do not apply excessive heat.)
5. Remove excess solder and resin from circuit board.
6. Remove new chip from protective packing material if applicable (CMOS devices).
7. Install chip in circuit. (Caution: Observe proper pin alignment to prevent improper installation.)
8. Connect heat sink and ground straps as necessary.
9. Solder chip.
10. Check for solder bridges.
11. Remove heat sink and ground straps.
12. Clean circuit of excess solder and resin.
13. Check for normal operations.

10. **TASK:** Replace PC Boards

**LEVEL:** Entry

75) PERFORMANCE OBJECTIVE

Using the tools and equipment listed and an electronic circuit having a defective PC board, replace the defective board. When replaced, the PC board must not wobble or vibrate, all connections must be electrically bonded and there must be no damage to the PC board or surrounding boards or circuits.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, adjustable
Iron, soldering
Solder, resin core
Pliers, diagonal
Flashlight

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to board.
3. Observe physical position of board.
4. Remove solder or plug connections from board.
5. Remove defective board.
6. Compare part numbers and revision levels of replacement board and defective board.
7. Ensure that replacement board is interchangeable with defective board.
8. Install replacement board being careful not to damage plug or board.
9. Make plug or solder connections as necessary.
10. Replace access covers.
11. Energize equipment.
12. Test for performance.

11. TASK: Replace Photo-Electric Relays

LEVEL: Entry

76) PERFORMANCE OBJECTIVE

Given an electronic circuit with defective photo-electric relays, and the tools and equipment listed, replace the photo-electric relays. When replaced, the photo-electric relays must not be loose, the electrical contacts must be continuous and the relays must function according to design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, Allen, assorted
Wrenches, socket set with assorted nut drivers
Pliers, needle nose
Pliers, diagonal
Flashlight

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to photo-electric relays.
3. Remove all connections from relays.
4. Remove defective relay.
5. Install replacement relay.
6. Connect all mechanical and electrical connections.
7. Replace access covers, panels, etc.
8. Energize equipment.
9. Test for performance.

12. **TASK:** Replace Pulley Belt

**LEVEL:** Entry

77) PERFORMANCE OBJECTIVE

Using the tools and equipment listed and an electronic circuit with a defective pulley belt, replace the pulley belt. When replaced, the belt must have no deterioration, frays, or unevenness, must be aligned with the pulley wheels and the tension of the belt must conform to design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, hex, assorted
Wrenches, open end, assorted
Pliers
Flashlight

PERFORMANCE GUIDE

1. Deenergize system.
2. Gain access to pulley belts (note belt path).
3. Remove defective belt.
4. Clean pulley.
5. Install replacement belt.
6. Make adjustments to pulley wheels (set tension).
7. Energize system.
8. Test for performance.
9. Deenergize system.
10. Replace access panels, covers, etc.

13. **TASK:** Replace Tape Head

**LEVEL:** Entry

78) PERFORMANCE OBJECTIVE

Given an electronic circuit containing a defective tape head and the tools and equipment listed, replace the tape head. When replaced, the tape head must be aligned, the electrical and mechanical connections secure, and the tape must be read with a minimum amount of distortion.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, hex, assorted
Wrench, adjustable
Iron, soldering
Solder, resin core
Flashlight
Brush, hair
Swab, cotton

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to tape head.
3. Mechanically unfasten tape head.
4. Remove defective tape head.
5. Insert replacement tape head. (Caution: When working with video tape heads, do not touch heads with bare hands; tape heads are very brittle.)
6. Realign tape head using NSTS recommendations.
7. Reattach all fasteners and connectors.
8. Replace access panels, covers, etc.
9. Test for performance.

14. **TASK:** Replace Klystron

**LEVEL:** Entry

79) PERFORMANCE OBJECTIVE

Given an electronic circuit with a defective klystron, and the tools and equipment listed, replace the klystron. When replaced, the klystrons will have secure mechanical and electrical connections and function according to the design specifications.

TOOLS AND EQUIPMENT

Screwdrivers, blade, assorted
Screwdrivers, phillips head, assorted
Wrenches, hex, assorted
Iron, soldering
Solder, resin core
Cloth, wiping
Flashlight
Nut drivers, assorted

PERFORMANCE GUIDE

1. Deenergize equipment.
2. Gain access to klystron.
3. Discharge klystron capacitor.
4. Remove electrical connections.
5. Remove mechanical connections.
6. Remove defective klystron as per manufacturer's recommendations.
7. Install replacement klystron as per manufacturer's recommendations.
8. Connect mechanical connections.
9. Connect electrical connections.
10. Replace access panels, covers, etc.
11. Test for performance.

F DUTY: ADMINISTERING PERSONNEL

1. TASK: Report Equipment-Related Safety Violations

LEVEL: Entry

80) PERFORMANCE OBJECTIVE

Given a list of equipment-related safety violations and safety violations report form, report the safety violations to supervisors. Reports should be concisely written and accidents categorized by equipment and type of safety violation.

TOOLS AND EQUIPMENT

Forms, safety violation
Pen/pencil
List, safety violations
Clipboard
List, supervisors

PERFORMANCE GUIDE

1. Review all safety violations recorded.
2. Identify equipment related violations.
3. Group specific equipment violations.
4. Group violations by potential severity (potential personal or property loss) under each category.
5. Summarize violation patterns.
6. Finalize report.

1. TASK: Administer Diagnostic Tests to Prospective Employees

LEVEL: Advancement

81) PERFORMANCE OBJECTIVE

Given prospective employees and employee diagnostic tests, administer the diagnostic tests to the prospective employees. The test will be administered in a work environment and conform to time limits specified.

TOOLS AND EQUIPMENT

Pencils
Paper
Erasers
Name tags
Timing device
Form, roster
Test materials

PERFORMANCE GUIDE

1. Obtain list of prospective employees.
2. Determine date and place test will be administered.
3. Reserve the testing room.
4. Notify prospective employees when and where test will be administered.
5. Fill out attendance roster on test day.
6. Pass out test and test equipment.
7. Explain test instructions.
8. Administer test for specified time limits.
9. Collect tests.

3. **TASK:** Develop Lesson Plan for Instruction/Demonstration

**LEVEL:** Advancement

82) PERFORMANCE OBJECTIVE

Given new equipment or product, engineering specifications, and product marketing plan, develop a set of lesson plans which include; performance objectives, student information sheets, overhead transparencies (if applicable), evaluation tool or instrument.

TOOLS AND EQUIPMENT

Engineering specifications
Product to demonstrate
Paper
Pencils

PERFORMANCE GUIDE

1. Review engineering specifications.
2. Review and operate new product.
3. Develop lesson plan.
4. Present instruction/demonstration to supervisor.
5. Administer evaluation device.
6. Review results of evaluation.

4. **TASK:** Conduct Instruction by Demonstration/Performance

**LEVEL:** Advancement

83) PERFORMANCE OBJECTIVE

Given a lesson plan, training aids and support equipment, and a group of trainees, conduct a training session using the demonstration performance technique. When the instruction is terminated, the lesson objectives will be met.

TOOLS AND EQUIPMENT

Lesson plan
Aids, training
Chalkboard
Chalk
Projector, overhead
Screen, projection
Evaluation device

PERFORMANCE GUIDE

1. Review lesson plan.
2. Review training aids.
3. Set up screen.
4. Position chalkboard.
5. Arrange teaching room or laboratory.
6. Present lesson.
7. Administer evaluation device.
8. Review results of evaluation.

5. TASK: Self-Evaluate Performance

LEVEL: Entry

84) PERFORMANCE OBJECTIVE

Given a performance rating device and job description, self-evaluate job performance according to the criteria reflected on the rating device. This rating should be an honest opinion of own performance.

TOOLS AND EQUIPMENT

Performance rating device
Job description
Pencil

PERFORMANCE GUIDE

1. Review of job description.
2. Review criteria on rating device.
3. Fill out rating device.
4. Discuss rating with supervisor.

6. TASK: Evaluate Employee Performance

LEVEL: Advancement

85) PERFORMANCE OBJECTIVE

Given a performance rating device and the job description(s) of employee(s), evaluate the job performance(s) according to the criteria reflected on the rating device. The rating should coincide with ratings performed by other evaluators.

TOOLS AND EQUIPMENT

Performance rating device
Job description(s)
Pencil
Clock
Eraser

PERFORMANCE GUIDE

1. Review incumbent's job description.
2. Review criteria listed on the rating device.
3. Determine observation period.
4. Observe employee performance.
5. Fill out rating device.
6. Discuss rating with ratee.

7. TASK: Evaluate Training Programs

LEVEL: Advancement

86) PERFORMANCE OBJECTIVE

Given operational training programs, the goals and objectives of the training programs, evaluate the training programs. The training program will be evaluated when it can be determined if the training program is meeting its goals and objectives.

TOOLS AND EQUIPMENT

Purpose of the evaluation
Goals of the evaluation
Evaluation instrument(s)
Pencil(s)
Program schedules
Roster of trainers
Roster of trainees
Training budget figure
Supervisor/trainee reports
Training aid list

PERFORMANCE GUIDE

1. Review stated purpose of the evaluation.
2. Review state goals of the evaluation.
3. Ensure program manager is aware of evaluation.
4. Provide program manager with evaluation agenda.
5. Conduct evaluation.
6. Compile results.
7. Review results with program manager.
8. Prepare final evaluation report.

8. **TASK:** Interview Prospective Employees

**LEVEL:** Advancement

87) PERFORMANCE OBJECTIVE

Using completed job application forms and resumes, interview prospective employees. Interviews should determine if a prospective employee has the qualifications to perform the job. Interview will be completed when it is determined if a prospective employee is or is not qualified to perform the job.

TOOLS AND EQUIPMENT

Room, interview
Chairs
Table, small
Desk
Job application forms
Paper
Pencil
Job description
Resume

PERFORMANCE GUIDE

1. Ensure a room or space within a room is available to conduct interviews.
2. Determine interviewing agenda for the day.
3. Contact interviewee and finalize appointment.
4. Review job description for position.
5. Review job application forms and resumes.
6. Determine questions to be asked of each prospective employee.
7. Conduct interviews.
8. Compare observations, interview results with job requirements.
9. Make recommendations.

9. **TASK:** Monitor Programmed Instructions

**LEVEL:** Advancement

88) PERFORMANCE OBJECTIVE

Given a group of trainees who have been administered the programmed instructions materials, monitor the progress of the program. The progress of each trainee should be current, and programmed instructions should be terminated as scheduled.

TOOLS AND EQUIPMENT

Guide, programmed instruction
Answer guide, master
Roster, trainee
Schedule, program instruction

PERFORMANCE GUIDE

1. Review program instruction schedules.
2. Determine where trainees should be in program.
3. Compare trainees programmed instruction completion sheet with proposed progress chart. Note deviations.
4. Advise trainees and supervisor of progress.

10. **TASK:** Orient Personnel to Procedures

**LEVEL:** Advancement

89) PERFORMANCE OBJECTIVE

Given policies or procedures, orient employees to the procedures to be used. All procedures must be explained in proper sequence and the acceptable performance indicated.

TOOLS AND EQUIPMENT

Policies or procedures
Aids, training
Chalkboard
Chalk
Projector, overhead
Eraser, chalkboard

PERFORMANCE GUIDE

1. Review procedures to be included in the orientation.
2. Study procedures.
3. List personnel that will be orientated.
4. Notify personnel time and place of orientation.
5. Pass out attendance roster.
6. Present procedures.
7. Answer questions.

11. **TASK:** Plan Work Schedules

**LEVEL:** Advancement

90) PERFORMANCE OBJECTIVE

Given work assignments and time blocks to accomplish the assignments, develop work schedules for the personnel involved. When completed, the work assignments will be covered within the timeframe allocated by personnel qualified to do the assignment.

TOOLS AND EQUIPMENT

Requirements, work, section
Calendar
Workers, list
Forms, work schedule
Pencils
Paper, writing
Erasers

PERFORMANCE GUIDE

1. Review work allocation requirements.
2. Review worker list.
3. Match skills and competencies of worker(s) to compatible areas.
4. Draft preliminary work schedule.
5. Notify shift foreman, supervisor, etc., of scheduling meeting.
6. Submit copies of tentative schedules to shift supervisors.
7. Record suggestions.
8. Modify schedule as necessary.
9. Print final work schedule.
10. Distribute work schedule to personnel.

## Tool/Equipment List

Frequency of Use:

1 = Low
2 = Medium
3 = High
* = Used by minimum number of employees (Less than half (4) of technical members indicated use.)
Items used less than medium frequency and rated by less than half of the committee are not included.

| | | | |
|---|---|---|---|
| *Circulators/isolators | 3.0 | *Box, bias | 2.0 |
| *Coil, degaussing | 3.0 | Brush, wire | 2.0 |
| *Deviation Monitor | 3.0 | Cable stripper | 2.0 |
| *Filter, universal tuning range to 60 KHZ | 3.0 | Calibrator crystal | 2.0 |
| | | *Cathode follower | 2.0 |
| Screwdrivers | 2.8 | Glasses, safety | 2.0 |
| Screwdrivers, phillips | 2.8 | Logic probe | 2.0 |
| Multimeter, digital | 2.6 | *Meter, distortion | 2.0 |
| Ohmmeter | 2.6 | *Meter, watt | 2.0 |
| Pliers, long nose | 2.6 | Milliammeter | 2.0 |
| Solder | 2.6 | Modulation scope | 2.0 |
| Test leads | 2.6 | Pliers, combination | 2.0 |
| Voltmeter | 2.6 | *Probe, R-F | 2.0 |
| Calculator, programmable | 2.6 | *Puller tube | 2.0 |
| *Checkers, module | 2.5 | *Scope, victor | 2.0 |
| Iron, Soldering | 2.5 | *Straightener, tube pan | 2.0 |
| *Marker, Adder | 2.5 | *Tracer, transistor curve | 2.0 |
| Pliers, diagonal | 2.5 | Cables, adapter | 1.9 |
| Pencil, soldering | 2.4 | Glue | 1.9 |
| Wrench, adjustable | 2.4 | Knife set, exacto | 1.9 |
| Clamps, alligator, assorted | 2.3 | Nut driver, hollow shaft Set 6/32" to 18/32" | 1.9 |
| Diagnostic tester | 2.3 | | |
| Graph paper | 2.3 | Rags, wiping | 1.9 |
| Strippers, wire | 2.3 | Tweezers | 1.9 |
| *Tester, transistor/FET with dynaflex probe | 2.3 | Calipers, 6" or smaller | 1.8 |
| | | Counter, frequency | 1.8 |
| Generator, pulse | 2.2 | Digital display scope, 16 trace | 1.8 |
| Logic chip | 2.2 | | |
| Pulse counter | 2.2 | Experimental board | 1.8 |
| Ammeter | 2.1 | Generator, audio (sine and square wave) | 1.8 |
| Cord, extension | 2.1 | | |
| Desoldering tool | 2.1 | Generator, R-F | 1.8 |
| Drill bits, #80 to 3/8" | 2.1 | Generator, signal | 1.8 |
| Lamp, magnifying, bench | 2.1 | Gun, soldering | 1.8 |
| Oscilloscope | 2.1 | Mirrors, small | 1.8 |
| Vise, machinists, swivel base, table | 2.1 | Puller, fuse | 1.8 |
| | | Vacuum cleaner (hand held, small attachments) | 1.8 |
| Wrench, Allen, assorted | 2.1 | | |
| Alignment tools | 2.0 | Wire wrap gun | 1.8 |
| Battery eliminator | 2.0 | Wrench, socket, 1/4" drive | 1.8 |

| | |
|---|---|
| Box, substitution, resistor, and capacitator | 1.7 |
| Braid, soldering | 1.7 |
| Brush, point (small) | 1.7 |
| Circuit chiller | 1.7 |
| Crimper, terminal | 1.7 |
| Drill, electric | 1.7 |
| Drill, hand | 1.7 |
| Epoxy | 1.7 |
| Fasteners, assorted | 1.7 |
| Heater, transistor | 1.7 |
| Micrometer | 1.7 |
| Probe, high voltage | 1.7 |
| Screwdriver, offset phillips | 1.7 |
| Sinks, heat | 1.7 |
| Glass, magnifying | 1.6 |
| Lubricant, silicon compound | 1.6 |
| Nutdriver and spline | 1.6 |
| Pliers, snapring | 1.6 |
| Screwdriver, offset | 1.6 |
| Spectrum analyzer (RF) | 1.6 |
| Thermometer, centigrade | 1.6 |
| Wrench, end, set 1/4" to 13/16" by 16ths | 1.6 |
| Checker, capacitor | 1.5 |
| Files, set, mill (6" to 12") | 1.5 |
| Grinder, 6", 1/2 HP | 1.5 |
| Headset, earphones and microphone | 1.5 |
| Meter, decibel | 1.5 |
| Punches, chassis, round | 1.5 |
| Recorder, X-Y | 1.5 |
| Signature analyzer | 1.5 |
| Gun rivet | 1.4 |
| Hammer, ballpeen | 1.4 |
| Punches, set (center pin, prick) | 1.4 |
| Wrenches, socket, metric, 1/4" drive set | 1.4 |
| Drill press, bench model, 15", slow speed | 1.3 |
| Flashlight | 1.3 |
| Hacksaw, adjustable | 1.3 |
| Kit, first aid | 1.3 |
| Reamer, hand, 1/8" tip, 5-1/2" long | 1.3 |
| Nibbling tools | 1.2 |
| Strip chart recorder, high speed | 1.0 |
| Tap and die set, electricians | 1.0 |

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